Urban Mobility – Simulating the future
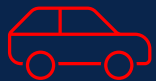
AITPM

Technical Webinar – 14th March 2023
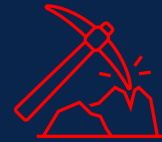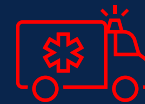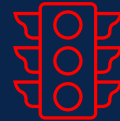
Presenter – Timothy Lim, Regional Head of Professional Services
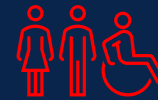
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Agenda

1. Introduction

2. Study Areas

3. Advocating for Improved Mobility

4. How can we do it in Aimsun Next?

5. Case Study 1 – example results

6. Summary of findings

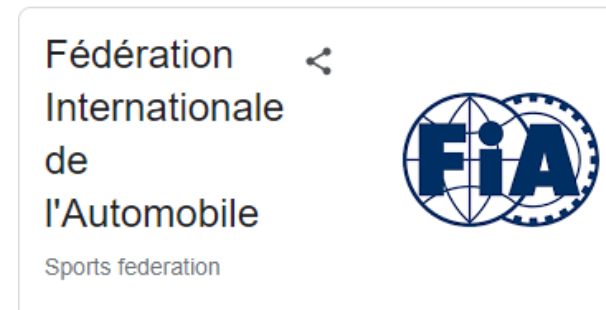7. Moving Forward

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1. Moving towards Mobility

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Is it good or is it bad?

- SAFETY ⚠️
- Active Mobility Users
- Personal Mobility Devices
- Impacts on our road environment

Fédération Internationale de l'Automobile

Sports federation

This study is commissioned by FIA as part of the FIA Mobility Advocate project ("FIAMA")
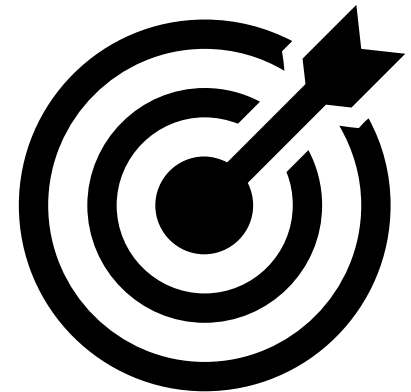
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1. Moving towards Mobility

Is it good or is it bad?

- **SAFETY** ⚠️
- Active Mobility Users
- Personal Mobility Devices (PMD)
- Impacts on our road environment
- **Aimsun Next** - What gets measured (properly), gets managed (if desirable)

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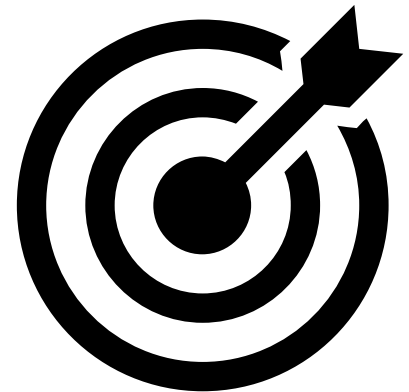
2. Study Areas

- Singapore
- Objectives / Assessments
  - Integration of PMD
  - Safe and complementary manner

- 3 selected sites -
  - a vibrant town center which is perfect for simulating a neighborhood environment
  - first-last mile commute of office workers will be simulated.
  - an area of high pedestrian footfall environment which represents leisure commuting

- Relative assessments (e.g. infrastructure, operation and competing priorities of road users)

Image by mrsiraphol on Freepik

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3. Advocating for Improved Mobility

- Competing priorities in each scenario – thus the impact on safety and other KPI are critical to determine which scenarios are worth pursuing

- An overly safe design result in very poor traffic performance, it is also not an ideal solution and vice versa.

Examples of the different costs and benefits borne by different motorists are as listed:

Motorists		Active users
• Delay		• Safety
• Speed	vs	• Delay at intersections
• Travel Time		• Level of comfort
• Number of Stops		• Sufficient crossing time
• Impact on emission		

Prioritise Active Mobility Users

Vehicle Flow — Active Mobility Users Flow — Vehicle Delay

—Vehicle —Pedestrian

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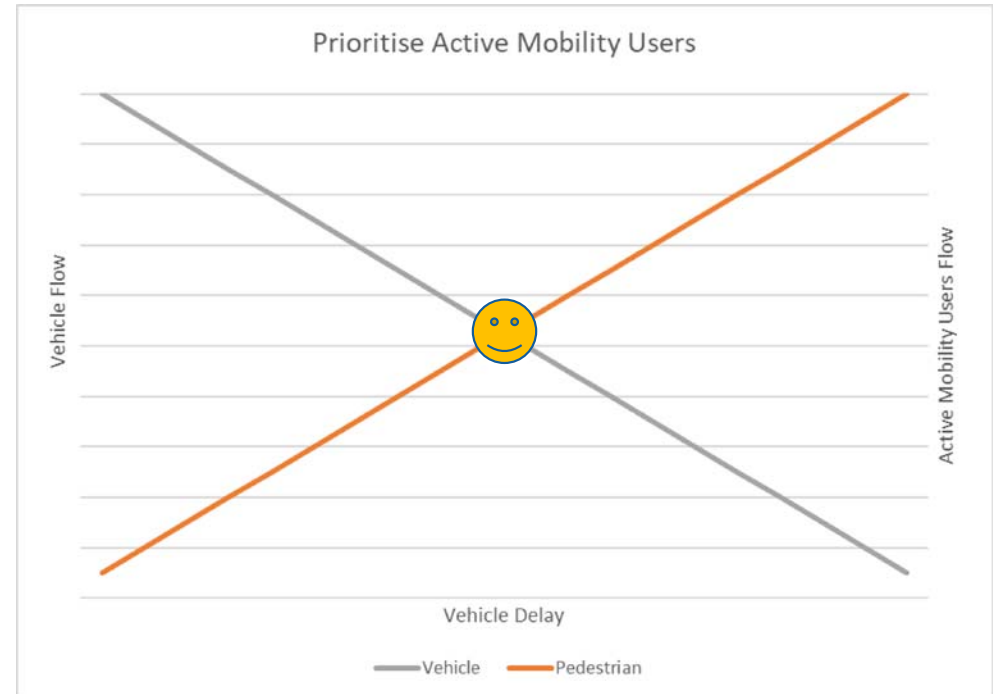
4. How - Safety from a simulation model?

- Inside a simulation model, the model entities will never collide.

- So – how do we determine if a particular scenario has a level of safety lower than another scenario?

- Let us consider what are some variables and outputs

  - Recorded trajectories of entities – how close they are in time and space to consider where their trajectories cross
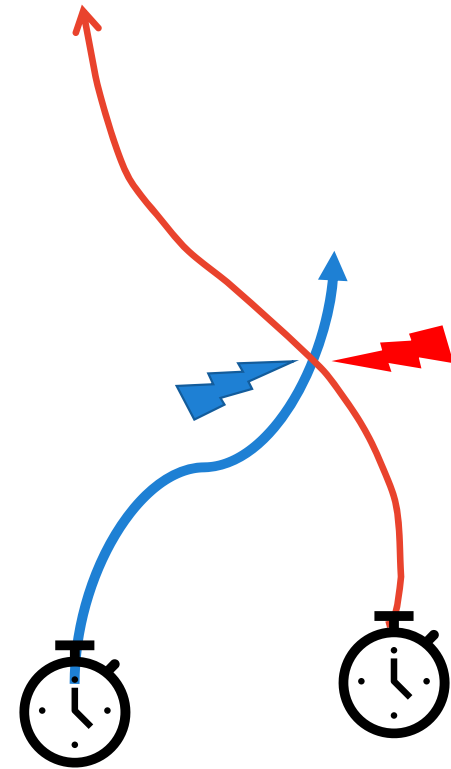
  - like the outputs of Surrogate Safety Assessment Model, SSAM (USDOT)

  - Speed of both entities

 - Mass of both entities

Surrogate Safety Assessment Model Overview

A simulation and analysis project with Federal Highway Administration (FHWA) to predict the safety of roadways before crashes occur.

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4. How - Piecing together the extracted outputs…

Possibility of collision

- Based on a rolling time window in the simulation
- Consider time to the expected collision point for both agents
- Possibility is a product of both arriving at the collision point at the same time
- Special consideration for stationary entities (if stationary before collision, we assume no collision – the entity has waited)
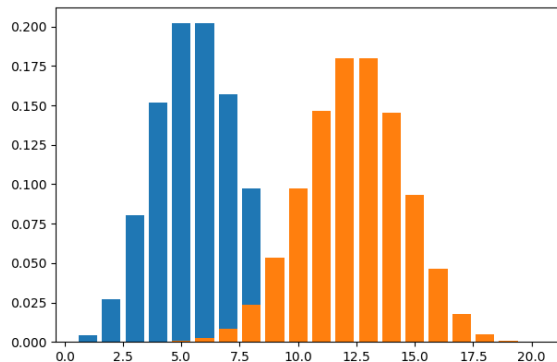
Severity of collision

- We can calculate the severity of impact based on the relative speeds at the collision points, the direction of travel, and the entities bulk.

- The severity of _____ both entities _____

Newton's Second Law: Force

The acceleration of an object depends on the mass of the object and the amount of force applied.

His second law defines a **force** to be equal to change in **momentum** (mass times velocity) per change in time. Momentum is defined to be the mass **m** of an object times its velocity **V**.

- The severity increases with mass of entities involved and their relative speeds.

4. How - Determining and implementing the Unsafe Indicator value

Unsafe indicator = **likelihood of accident** × **severity of accident**

The unsafe indicator value is determined by, the probabili... ...llision multiplied by the severity of collision.

Hence, the higher the unsafe indicator value, th... ...fety.

We can then do individual analysi... ...s recorded for a specified area.

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Pedestrians (Types)
- ● Cyclist
- ● Pedestrian
- ● Personal Mobility Aid
- ● Personal Mobility Device
- ● Power Assisted Bikes
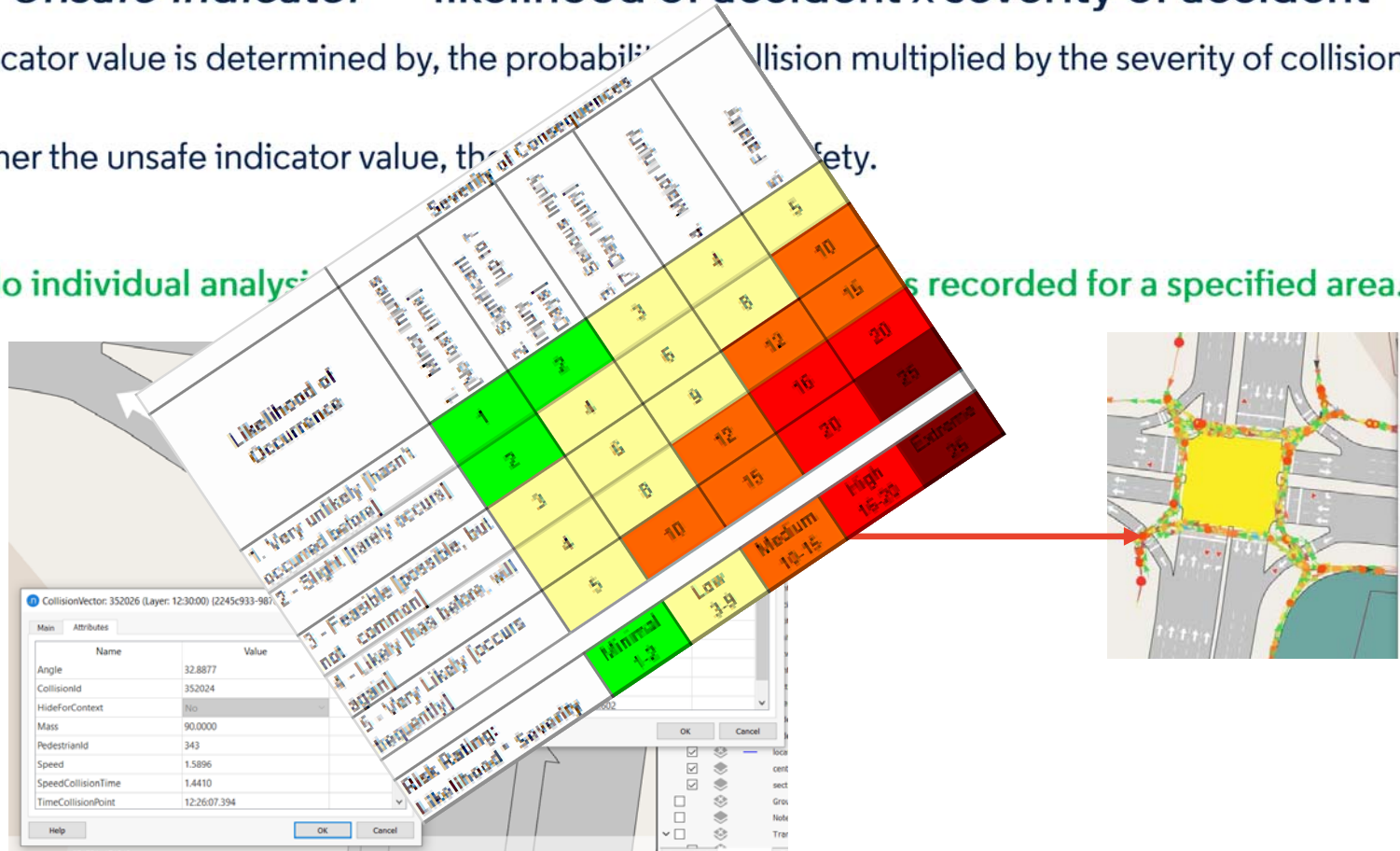
5. Case Study 1 – Option 1 and Option 2 (General Findings)

1a Increasing cycling demand by 250%

1b Increasing cycling demand by 500%

2a Increasing cycling demand by 250% + additional active mobility demand

2b increasing cycling demand by 500% + additional active mobility demand

Comparison of Mean Unsafe Indicator Values

BAU ■ 1a + 250% ■ 2a + 250% + escooter ■ 1b + 500% ■ 2b + 500% + escooter
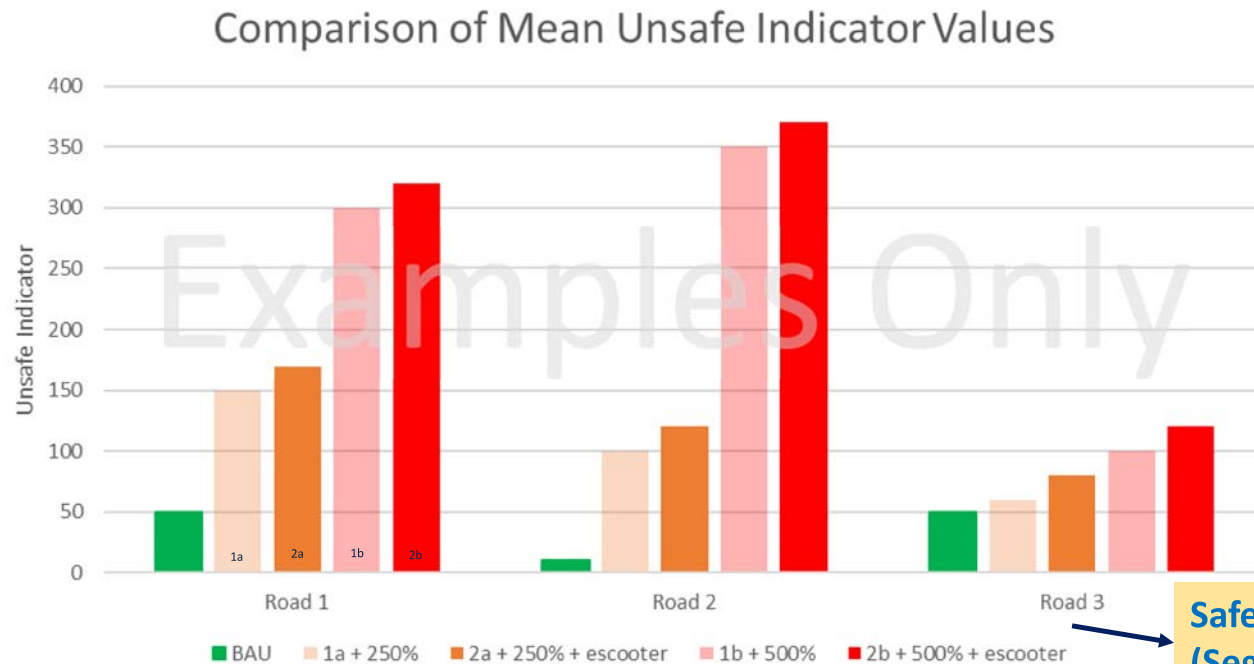
Safety by Design (Segregated)

Standard Deviation +++   **Standard Deviation +**

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5. Case Study 1 – Option 3 (Outputs by Intersection by approach)

Existing

Opt 3

Opt 3 - Remove slip road + provide a wider pedestrian crossing

Impact on vehicular traffic

Average Intersection Approach Delay

Examples Only

Delay						
62						
60						
58						
56						
54						
52						
50						
48						
	12:15	12:30	12:45	13:00	13:15	13:30

● BAU   ● Opt 3

Max Queue
Speed
Stop
Total Travel Time
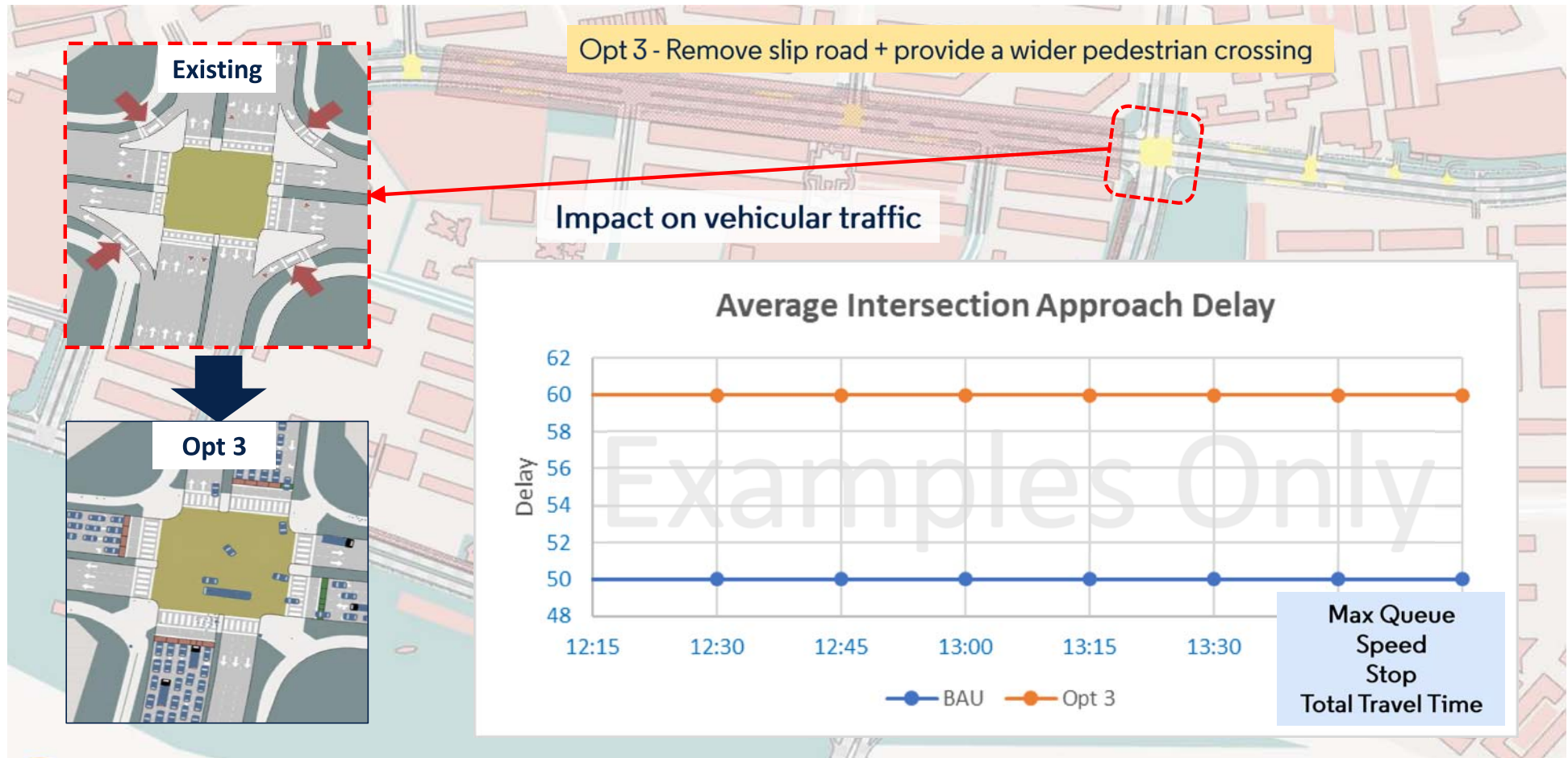
5. Case Study 1 – Option 3 (Outputs by user types)
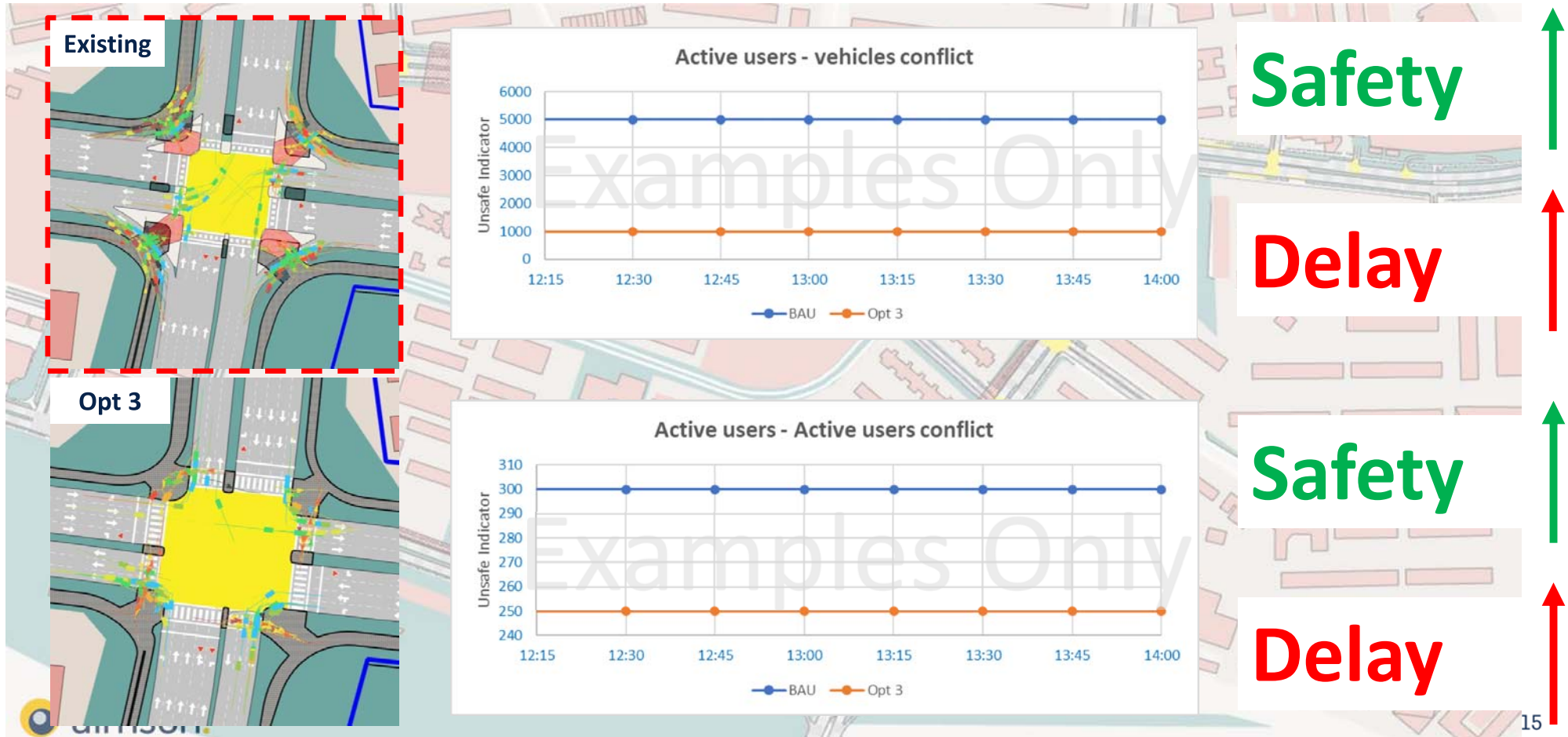
6. Summary of findings

- Increasing number of cyclists increases number and severity of collisions between active users.

- Increasing path width may not necessarily improve the level of safety as it may encourage cyclists or device-users to travel at faster speeds

- Removing intersection slip roads increases vehicles delays but generally results in increased level of safety for active mobility users.

  - Active users are more likely to stop or have lower speed at crossings points, reducing severity of collisions

  - Travel times reduced for all active mobility users (fewer wait points).

- Bicycle boxes help avoid risk of collision, especially where combined with a pre-signal for cyclists.

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7. Moving Forward – How can the tool be used?

- **Quantify** - Provide a basis to quantify 'safety by design' to determine if proposed infrastructure changes/policy changes are people-friendly vs machine friendly.

- **Enhance** - Enhance the current process and increase its robustness to achieve a more balanced outcomes to all road users (e.g. not only delay)

- **Decision** - used to determine the efficacy of planned infrastructure and support policy changes

- **Good news** - all within Aimsun Next simulation environment

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